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UNITED STATES DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE  
Summary Review of Monthly Reports\*  
for  
SOIL CONSERVATION SERVICE RESEARCH\*\*  
SEPTEMBER 1946

EROSION CONTROL PRACTICES DIVISION

Report of the Ninth Annual Field Day at the Floris Station, Tuesday September 3, 1946 - J. M. Aikman, Ames, Iowa. - "Our field day is a day conveniently set aside each year for interested farmers to visit with farm specialists and research leaders on the ground where soil conservation and related phases of land-use problems of hilly land are being studied and adapted to useful farm practices.

"Who wants it is best answered by the following numerical analysis of the attendance. On the basis of an attendance of 600 the approximate numbers were: farmers - 500; newspaper personnel - 10; county officials - 10; conservation district officials - 25; vocational education teachers - 5; county agents - 10; district and work unit officials - 20; directors, deans and research and extension specialists from the college - 20.

"The forenoon was devoted to systematic field tours of the experiments and demonstrations being carried out on the farm. The several specialists were placed at definite stations on the farm and the groups were conducted from one station to the other by the leaders (technical agents and local advisors) two to each group. Practically everybody in attendance went on the tours.

"The afternoon was devoted to clinics, group conferences and general discussion.

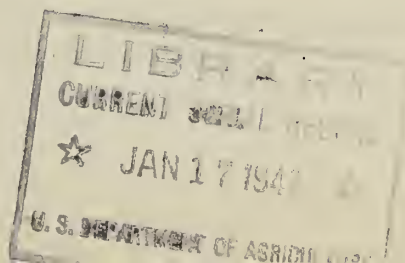
"Canning demonstrations were conducted in the basement laboratory by specialists throughout the day.

Summary of Points Stressed - "H. L. Lantz and assistants demonstrated the importance of fruit growing in the utilization of steep eroded land in southern Iowa. He emphasized the value of home grown fruit to the farmer, the opportunity to add to the income by fruit growing, the necessity of having the rows on the contour and using cover crops and as little cultivation as necessary in growing fruit and at the same time conserving and building soil on the steep slopes.

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"Horace B. Cheney showed soil profiles in the field to explain the reason for the low productivity of eroded soils. He described methods of building up and maintaining the fertility of eroded soils. He discussed commercial fertilizer amendments but emphasized the importance of the use of grass and legume covers and of barnyard manure. He computed the actual dollar and cents value of soil improvement.

"Howard E. Brewer used the legume plots which he established in 1940 to demonstrate that birdsfoot trefoil and Korean lespedeza were best adapted to the eroded soils of low fertility and low pH on which the plots were established. Sericea lespedeza has proved to be much better adapted than at first believed and; although of less economic value than either of these two, ranks higher as a soil builder. Birdsfoot trefoil is the best competitor of the three and Korean lespedeza can be established on soil of lower fertility level.

"E. P. Sylwester identified weeds in the field and distinguished between harmful weeds and those less harmful or even beneficial in conserving and building soil. He discussed methods of weed eradication including cultural methods and some of the new weed killers. He used the demonstration weed eradication plots to show that the new differential weed sprays offer much promise.

Donald Coe and assistant demonstrated that plant disease and insect problems were less serious than might be expected in growing fruit under minimum culture on hilly land. He emphasized sanitation methods in the control of brown rot and other fruit diseases. He demonstrated the effectiveness of firmate as compared to lime sulphur sprays.

"Frank C. Pellett, Field Editor of the American Bee Journal and F. B. Paddock demonstrated the bee plant plots and presented bee keeping as a proved source of added income on farms with a large percentage of eroded and waste land. Pollination of fruit trees and increased production of red clover seed are by-products. Anise hyssop is a very promising bee plant for cheap land and mountain mint has high value as a source of methol as well as of nectar. The original 10 hives of bees purchased in 1940 have expanded to 15 extra strong hives and have returned the purchase price every year but one.

"Details of many other experiments on the farm were answered by the conductors during the tours.

"The project supervisor briefly discussed the present status of the following experiments which had not been discussed by the specialists on the field tours:

New data have been obtained on the effect of topography on frost injury caused by cold air drainage which explain differences in injury among kinds of fruits and nuts and from year to year. Cold periods in a pollinating season can adversely affect the degree of pollination of plums and other fruits.

Ten year-old plantings of black locust (one within site of the speaker's stand) are beginning to bear useable posts.



Thomas and Stabler black walnuts grown in soil conserving basins have reached bearing size in 9 years and give promise of producing a valuable crop in eroded land of low value.

Grass and legume mixtures have been fitted to the specific plant growth and soil building conditions of steep eroded soils.

Another leading extract company has reported that sumac leaf harvested and processed for tannin at the Floris station was the best domestic leaf which they have ever used and that its quality justifies the payment of the extra freight rate as compared to the eastern product.

As a result of the high production of high grade clover honey at the Floris station, northern and central Iowa honey producers are interested in bringing their bees into the vicinity for bee pasturage and for cooperation with farmers in increased production of red clover seed.

Studies at the station with anise hyssop and mountain mint as sources of honey and volatile oils indicate that the growing of these two plants for honey production on cheap eroded land in southern Iowa may be entirely feasible.

"Dr. H. H. Kildee, Dean of Agriculture and Director of the Extension Service of Iowa State College, discussed the subject, "Agriculture Looks Ahead". In the near future he said, many acres plowed up in Iowa during the war must be returned to soil conserving crops. This means that land use problems on all of our land must be carefully studied to be sure that it is being put to the best possible use. He stated that even at present and especially in the future, farmers must give more attention to cooperation in planning their programs, the use of machinery, marketing, and carrying out soil conservation projects. Iowa will be called on in the future more than today to provide meat products for the nation and the world. In this connection, Dean Kildee predicted that the trend in marketing will be toward price differentiation based on grading for preferred types of animals.

"Mr. Kenneth King, Assistant State Conservationist, emphasized the importance of education and cooperation in the Soil Conservation Program. In his opinion, the neighborhood group is the logical unit to take the initiative in carrying out an education and action program. The education program should start in the local public schools of the neighborhood by having the children learn about conservation and become interested in it by carrying on simple experiments. He described the manner in which a well organized and directed soil conservation district operates.

"Because of the interest, industry and fine cooperative spirit of the local advisory committee, our other neighbors, and our many other friends, official and unofficial, this was the "smoothest running" field day we have had. Not by any means the least of the contributions to the success of the field day was the excellent service rendered by the women of the neighborhood in providing an appetizing and satisfying lunch for all the visitors. The chief hillculture crops enjoyed by the visitors were plenty of watermelons and grapes."

Teaching Soil Conservation at LaCrosse Research Station - O. E. Hays, LaCrosse, Wisconsin.-"A number of groups of school children visited the Station during the month. Mr. Bay has prepared two demonstrations in addition to showing the plot work. One consists of two miniature plots, one fallow and the other with bluegrass. Water is applied to these plots so that the students can observe the ability of vegetation to control runoff and erosion. The other demonstration consists of two small hills of soil, one contoured, the other with rows up and down hill. The teachers have indicated that these trips are very much worthwhile in their conservation teaching program."

The Effect of Straw Mulch on Grain Yield of Barley - Maurice Donnelly, Riverside, California.-"To obtain further information on the effects of straw in relation to stubble mulching on grain land in southern California, plots were established at Riverside, California, in the fall of 1945. The land had previously been in volunteer winter cover crop. Nitrate content at time of planting was low. All plots received identical treatment except that clean, bright barley straw was spread at different rates of application on some of the plots after seeding barley. Yields of barley for the several plots are given below:

Yield	Rate of Barley-Straw Mulch Application in Pounds Per Acre				
	None	500 lbs.	1000 lbs.	2000 lbs.	4000 lbs.
In Percent	100	126	146	190	220
In Pounds of Grain Per Acre	200	252	291	379	440

"The increased yield of barley on the mulched plots is ascribed mainly to reduction of evaporation of water from these plots. It should be borne in mind in connection with the above data (1) that they are only for a single year, (2) that soil nitrate levels were low at the time of planting, and (3) that surface evaporation was unusually high in the winter of 1946."

Volunteer Wheat on Fallow Land- Torlief S. Aasheim, Bozeman, Montana.-"An unusual amount of growth of volunteer wheat has made it necessary to cultivate some of the summer fallow at Culbertson during the month. Nearly all fallow in this part of the State which was not cultivated during September is densely covered with a growth of volunteer wheat. It is difficult to understand why this wheat has not germinated earlier this season. This fall growth of wheat is not present on mold board plowed fallow but occurs on oneway fallow and sub-surface tilled fallow."

Cropping Practices in Relation to Moisture Storage in Wheat Land - A. E. Lowe, Garden City, Kansas.-"Soil moisture samples were taken on the wheat plots soon after seeding and all the fallow plots had 4 feet of moisture penetration except the subsurface tilled plot which had only three feet. The continuous cropped plots had only about one foot of moisture penetration. The amount of moisture stored is less than for several years, and with average rainfall between now and harvest the expectation with four feet of soil moisture is about 18 bushels of wheat per acre."



Straw Mulch and Nitrogen Fertilizer Improved Wheat Yield - C. A. Van Doren, Urbana, Illinois.-

Winter Wheat Yields - Mulch Plots - Dixon Springs - 1946

Tillage	: Preceding Crop Meadow :		: Preceding Crop Corn :	
	: No :		: No :	
	: Nitrogen : (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> :		: Nitrogen : (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> :	
Grain Yields-Bu./Acre	:	:	:	:
Plowed	:	17.0	:	15.5
Plowed	:	:	:	16.3
Sub-tilled	:	17.3	:	17.4
Sub-tilled	:	:	:	19.1
Plowed-Mulch <sup>(3)</sup>	:	18.7	:	17.7
Plowed-Mulch	:	:	:	18.2
	:	:	:	:
Straw Yields-Tons/Acre	:	:	:	:
Plowed	:	1.83	:	1.63
Plowed	:	:	:	1.75
Sub-tilled	:	1.84	:	1.77
Sub-tilled	:	:	:	1.88
Plowed-mulch	:	1.93	:	1.84
Plowed-mulch	:	:	:	2.04
	:	:	:	:

(1) Nitrogen applied fall 1945.

(2) Nitrogen applied spring 1945.

(3) One ton barley straw.

"Phosphate was drilled in at seeding time at the rate of 230 lbs. per acre and limestone (3-1/2 tons per acre), rock phosphate (1000 lbs. per acre) in spring 1937."

Fertilizer and Spacing in Relation to Wheat Yield - Harley A. Daniel, Guthrie, Oklahoma.-"Nitrogen and phosphorus fertilizer were applied to wheat at the Cherokee station last fall. The results are as follows:

Yield of Wheat from Fertilized Plots at the Wheatland Conservation Experiment Station, Cherokee, Oklahoma, 1946

Treatment <sup>1/</sup>	: Yield Per Acre <sup>2/</sup>	
	: Straw Tons :	: Grain
Check	: 1.04	: 20.9
Superphosphate	: 1.13	: 22.5
Superphosphate & ammonium nitrate	: 1.28	: 25.7
Ammonium nitrate (fall)	: 1.10	: 19.8
Ammonium nitrate (spring)	: 0.91	: 18.1
Wheat Wide Row <sup>3/</sup>	: 1.15	: 24.3
Wheat Wide Row & superphosphate <sup>3/</sup>	: 1.59	: 36.9

<sup>1/</sup> Superphosphate (20%) applied at the rate of 250 lbs. per acre and ammonium nitrate at the rate of 100 lbs. per acre.

<sup>2/</sup> Average of triplicate planting.

<sup>3/</sup> Wheat rows 20 inches apart. Sweet clover was planted between these rows but it failed due to dry weather.

"Although these results represent one year only, they tend to show the importance of moisture and phosphorus fertilizer for wheat production in northwestern Oklahoma. The higher production from the wide row spacing indicates the importance of moisture. The full value of fertilizer is not obtained unless it is applied in combination with the best possible soil and water saving practices."

Wheat Yields and Tillage Methods - C. L. Englehorn, Fargo, North Dakota.-

Yield of Wheat in Bushels an Acre as Affected by the Method of Tillage of Wheat Stubble for Seeding to Spring Wheat, Langdon

Method of tillage	1	2	3	Average
Moldboard plow, fall	22.3	22.2	20.7	21.7
Moldboard plow, spring	19.8	22.5	19.3	20.5
Oneway disk, fall	15.7	18.7	16.8	17.1
Field cultivator (duckfoot), fall	15.3	18.0	16.7	16.7
Stubble mulch (subsurface), fall	14.2	15.3	13.8	14.4

"Where tillage was for seedbed preparation for spring wheat the highest yield was obtained from moldboard plowing and the lowest from stubble mulch tillage. Tillage with the oneway disk and that with the duckfoot cultivator produced a lesser yield than plowing but a higher yield than stubble mulch tillage. At Langdon, the tendency has been, since the plots were laid out in the fall of 1940, toward this inverse variation in yield with variation in the amount of surface residue. At other points within the State yields from stubble mulch tillage have more nearly equalled yields from plowed land.

Yield of wheat in bushels an acre as affected by method of tillage for summer fallow, Langdon

Method of tillage	Yield of wheat, bushels an acre			
	1	2	3	Average
Moldboard plow, duckfoot	27.0	28.3	30.0	28.4
Moldboard plow, duckfoot, pit	27.2	29.7	29.7	28.9
Duckfoot, all operations	26.7	31.3	32.0	30.0
Stubble mulch (subsurface)	25.5	27.3	28.7	27.2

"Though the yields from summer fallow varied less with tillage method than did the yields under continuous cropping, stubble mulch tillage produced a somewhat lesser yield than did either tillage with the duckfoot cultivator or moldboard plow. The highest yield during 1946 was from plots tilled during 1945 with the duckfoot cultivator."



Wheat Yields in Bushels Per Acre for the Tillage and Residue Treatment Trials. Tetonia Branch Experiment Station, 1946 - Hugh C. McKay, St. Anthony, Idaho.-

Type of Plowing	Straw Utilized					Average
	Straw Burned	Rod weed when necessary	Rod weed immediately	Rod weed when necessary	Spring disk.	Fall disk
Moldboard	35.0	35.3	34.6	29.4	33.4	33.5
One way disk	29.5	33.0	29.9	31.4	32.8	31.3
Modified Mold.	33.2	33.9	32.1	34.0	34.9	33.6
Calkins Weeder with shovel attachment	29.9	32.4	32.2	33.7	34.2	32.5
Fall plow-Modified moldboard	33.7	30.4	32.2	31.5	32.5	32.1
Average	32.3	33.0	32.2	32.0	33.6	

"The modified moldboard and the moldboard plows gave the highest average yields. The one way disk gave the lowest average yield. The difference between the highest and lowest is only 2.3 bushels which is not a large difference.

"In the residue treatments fall disking gave the highest average yield, but the difference between any of the treatments is not great. Burning of all straw residues did not give an increase in yields as it sometimes has. Only a light straw residue was present and did not interfere in any of the tillage or seeding operations."

Soil Moisture Near All-Time Low on Wheat Land - C. J. Whitfield, Amarillo, Texas.-"With continued drought, soil moisture conditions are extremely unfavorable for wheat seeding. Wheat seeded on September 11 had not emerged by the end of the month. Available moisture in a 4-foot profile is near the all-time low of 1940. Soil moisture conditions on September 12 are shown in the following table:

Depth of Sample	Field G-3	
	Continuous wheat	Fallow for Wheat
Inches	Available Moisture	Available Moisture
	Inches	Inches
0-6	.17	.32
6-12	.16	.47
12-24	.15	.86
24-36	.16	.65
36-48	.31	.53
Total	.95	2.83

"Under average conditions, available moisture at this time should be approximately 3.50 to 4 inches for continuous wheat, and 5.75 to 6.50 inches on fallow land for wheat.

Results of Five Years' Tests of Stubble-Mulch Tillage Versus Onewaying -

"On the stubble-mulch plots, the yields are an average of plots tilled with 30-inch sweeps and the Noble blade as they are both stubble-mulching type implements that leave a maximum of residue on the surface. Tillage on both continuous wheat and fallow was started as soon after harvest as possible. Tillage after the initial cultivation was needed to control weed growth and volunteer wheat. On continuous wheat, stubble-mulching gave an increase in grain yield of 1.3 bushel per acre and on fallow, an increase of 3 bushels per acre. While grain yields are important, it is felt that the principal advantage in stubble-mulch tillage is the better cover left on the surface for protection against wind erosion. The grain yields in bushels per acre are given in the following table:

Tillage Practice	Stubble-Mulch Plots					
	Yield - Bushels per acre					
	1942	1943	1944	1945	1946	Ave.
Continuous wheat - Oneway (clean tillage)	20.1	6.0	20.9	6.3	2.6	13.2
Continuous wheat - Stubble-mulch	19.1	7.1	33.4	6.9	6.0	14.5
Wheat on Fallow - Oneway (clean)	--	11.9	35.8	16.7	8.5	18.2
Wheat on Fallow - Stubble-mulch	--	14.6	35.9	20.4	13.9	21.2

Potato Yields as Influenced by Rotations and Irrigation - O. R.

Neal, New Brunswick, New Jersey.-"Yields from the potato rotation plots at the Vegetable Research Farm at New Brunswick were as follows:

Plot No.	Rotation	Not Irrigated	Irrigated
		Bu./A.	Bu./A.
2	Continuous.	179.9	207.3
12	Continuous	207.3	219.1
.	Average	193.6	213.2
6	2-year	233.1	257.1
10	2-year	200.0	242.5
	Average	216.6	249.8
5	3-year	229.4	261.6
11	3-year	233.4	244.7
	Average	231.4	253.2

"It was pointed out in Dr. Richards' report last month that the irrigation on these plots brought about a yield increase of about 11%. The above data also show that the yield from continuous cultivation with supplemental irrigation was slightly less than that from the rotation plots without irrigation. This is in accordance with our runoff results from other areas which show that crop rotation reduces runoff and thereby provides more moisture for crop use."

Nitrogen Level of Protected Soil - Joel E. Fletcher, Tuscon, Arizona.-"Nitrogen levels in the rain-crust and in the layer immediately thereunder were determined under several different cover treatments. Under crops or treatments that held the moisture in the surface and still allowed light to reach the soil surface nitrogen levels increased rapidly from February to May, when temperatures and growth rapidly began to reduce them toward the original level in summer growing crops and only very slowly under winter crops. The increase in nitrogen reached levels as high as three fold the original level."

Can Earthworms Be Used To Restore Eroded Soil? - Henry Hopp, Beltsville, Maryland.-"As part of the Earthworm Project, the following preliminary laboratory test was made. A highly eroded fine sandy loam was taken from a 10% slope that had been cropped up-and-down hill continuously to tobacco for 7 years. Sericea lespedeza litter (3 percent by weight) was applied to half the cultures. Water-stable aggregation tests on the soil gave the following results after 1 week:

Treatment of eroded soil	Water-stable aggregation (percent)
No litter, no earthworms	5.7
Litter, no earthworms	6.8
No litter, earthworms	4.7
Litter and earthworms	10.3

"The earthworms ate both the litter and the soil. The aggregates they produced had all the appearances of dark-colored topsoil. The marked improvement in aggregation where both earthworms and litter were applied has some interesting implications for the restoration of structure in eroded soil."

Publications - "Two papers entitled 'Earthworms as a Factor in the Formation of Water-Stable Soil Aggregates' and 'The Effect of Cropping Systems on the Winter Population of Earthworms', by Henry Hopp and Homer T. Hopkins appeared in the first and second issues (July and October), respectively of the new Journal of Soil and Water Conservation. These papers point to a little-understood field in soil conservation. They show, for the first time, that earthworms may be an important factor in the formation of water-stable aggregate structure in soil and that it is possible to devise practical cropping systems for maintaining the earthworm population."



Beef Cattle Continue to Make Good Gains on Grassland - H. W. Black, Zanesville, Ohio.-"Twenty-two head of mixed breeds of beef cattle were sold during the latter part of September. Grass gains for the year (353 days) averaged 412 pounds per steer. Approximately 2 acres of land was required to produce this gain. Feed consisted of mixed hay alone during 5 winter months, improved bluegrass during the spring and alfalfa-ladino grass meadow pasture during the summer. About 7 bushels of corn and cob meal was fed on pasture during the last 10 weeks. These steers cost an average of \$12.40 at 641 pounds and sold for an average of \$18.40. While these gains may not be spectacular, they do represent a fair income from worn out cropland which was seeded down to legume grass mixtures. More detailed information will be given in the future."

Volunteer Rye Grass and Crimson Clover and Winter Pasture - B. H. Hendrickson, Watkinsville, Georgia.-"Perhaps the most interesting development on the Station during September was the rapid early growth of volunteering crimson clover and ryegrass in the 4.5 acre temporary winter pasture, which was opened to grazing unusually early by the Station beef cattle herd on October 6. This sloping field of low-grade Class III land was first sown in this mixture in the fall of 1945. It supplied somewhat better winter grazing than a companion pasture sown to oats for the same purpose. Cattle were taken off of the clover-grass sod April 15, and a heavy crop of ryegrass seed was combine-harvested in June. The grass-and clover-residue-covered stubble was well disced after an August rain, after 500 pounds per acre of complete fertilizer had been distributed. The resulting volunteer clover and grass growth completely covered the field during September, including numerous red clay galled areas of exposed subsoil. Good winter grazing is in prospect, for comparison with several other areas in trial plantings."

Meeting of the Regional Terrace Committee - Maurice Donnelly, Riverside, California.-"The Regional Terrace Committee met in the project office on September 18. Present were Mr. E. J. Core, Chairman, and Messrs. Kohler, Raznoff, Rich, Wilkens, and Donnelly. The discussion centered mainly on evaluating the performance of existing terraces and related structures in southern California in order to obtain better guides on spacing of terraces and diversions. A considerable body of experience, especially with diversion systems, has been developed in Ventura and Santa Barbara Counties. Because of the wide range of soils encountered in field work, the committee will adjust the regional engineering data on terrace system planning by a variable based on physical characteristics of soils. For this purpose, soils will be classified by the Soils Division into a limited number of groups, possibly four or five."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - J. A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebraska. - "The September rainfall at the Meteorological Station totaled 5.52 inches as compared to the average of 2.57 inches for the past 51 years. A total of 2.05 inches and 1.53 inches were recorded on September 6th and 7th, respectively. Other rains were small and well distributed during the month. The above normal rainfall in July, August, and September brought the accumulated rainfall for the year up to a little above normal to offset the deficit of 4.1 inches on July 1.

"The seeding of wheat was completed on the small watersheds on September 25 and a good stand was obtained on all the areas. Soil-moisture conditions favor a good wheat crop next year and we are practically assured of above normal yield in this vicinity for 1947. The corn will be ready for harvest in about 2 weeks. To date we have not received a damaging frost which has been beneficial to some of the corn.

"Following is a tabulation of the peak flows on the small watersheds on September 6, 1946. Maximum rainfall intensities were about 3.5 inches per hour.

Watershed No.	Land Use	Peak c.f.s.
4H	Corn st. rows	7.5
12H	" " "	12.1
8H	Corn contoured	0.2
17H	" "	1.7
11H	Corn subtilled	6.4
19H	" "	7.7
24H	" "	3.5
5H	Wheat stubble-st. rows	3.8
13H	" " " "	9.0
3H	" " contoured	8.5
16H	" " "	8.9
14H	" " subtilled	5.2
20H	" " "	7.9
22H	" " "	3.1
6H	Plowed-st. rows <sup>1/</sup>	15.7
15H	" " "	10.7
7H	" contoured	15.3
9H	" "	9.3
10H	Subtilled	5.8
21H	"	7.9
23H	"	1.5

<sup>1/</sup> Oat ground prepared for seeding of wheat.

Hydrologic Studies - R. B. Hickok, Lafayette, Indiana.-"Two watersheds in corn under prevailing treatment lost 0.12 and 0.18 inch in runoff from a rain storm which occurred in September, with no significant runoff from the conservation treated corn watersheds, nor those in soybeans under either conservation or 'prevailing' treatment. There was only slight runoff from pasture watersheds on the Dairy Farm and none from those in woods.

"Total solids in runoff from 'prevailing' practice corn on September 23rd was found to be 1,160 lbs./acre-inch for one watershed and 1,030 for another, compared to 139 lbs./acre-inch in the very slight runoff from one watershed in soybeans. Records for this year to date have shown considerably less soil loss from beans than from corn.

"A manual, 'Processing of Runoff and Precipitation Data,' was prepared, outlining the procedures of compiling the basic data and also their routine summarization and indexing at this Station. It is intended not only for use of clerical assistance doing the processing, but also as a guide to the technicians concerned with interpreting and reporting the results of our research. Copies will be furnished the Project staff and Collaborators."

Runoff Studies - T. W. Edminster, Blacksburg, Virginia.-"During the month of September considerable emphasis was placed upon the farm pond leakage problem. At the request of Operations Personnel, the Project Supervisor and Mr. D. B. Krimgold of the Washington Office met with Operations engineers and other technicians to study the problem in the Lord Fairfax District. Following that trip the Project Supervisor made further investigations in the Shenandoah Valley District. On the basis of these surveys, a special Virginia farm pond problem report was prepared and transmitted to the Washington Office on September 27.

"The first twenty-six pages of Part I of the proposed report on 'Rates of Runoff in the Ridges and Valleys Region of Virginia' have been roughed in and typed. Upon completion of Part II, the manuscript will be ready for checking by the interested parties."

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minnesota.-"Mr. Anderson spent the entire month testing the 4-1/2 and 2-1/4 inch drop-inlet pipe culverts. The effect of approach channel width on the head-discharge curve was investigated by varying the width from 10.5 to 21.2 times the diameter of the pipe. No significant effect was discovered. The flow behind the headwalls, to which the dissimilarity between the head-discharge curve for the several models was traced, was eliminated. Sixteen test runs were made on the 4-1/2 inch model and 18 runs on the 2-1/4 inch model. Similar head-discharge curves were obtained for the two models. The vacuums and pressures within the model compare very well except for one piezometer. The reason for the discrepancy at this piezometer is now being investigated.



"Mr. Donnelly completed a model of the box drop spillway which will be used for the planned series of submergence tests. The model has been installed in the test channel. The model will be ready for testing as soon as zero readings are obtained.

"Mr. Blaisdell completed the rough draft of a report on the Lower Caney Lake outlet structure to be constructed at Minden, La. This report is being prepared for the Region 4 Engineering Division of the Soil Conservation Service."

Hydraulic Studies - W. O. Ree, Stillwater, Oklahoma.-"During September the following experiments were completed:

Table 1

Chan.	: Expt.:	Cover	: Bed : Bottom: Side : Number of : slope: width : slopes: flows
U2	4	Bermuda grass, green, short	0.05 3 1/ 62/
U3	7	Bermuda grass, green, short	.05 3 1/ 62/
U4	2	Ischaemum, green, short	.05 3 1/ 11
U5	4	Lovegrass, green, medium	.05 3 1/ 9
U6	4	Lovegrass, green, long	.05 3 1/ 10
FC1A	1	Native grass mixture	.03 0 10:1 11
FC1B	1	Native grass mixture	.06 0 10:1 11
FC2A	1	Weeping lovegrass	.03 0 10:1 10
FC2B	1	Weeping lovegrass	.06 0 10:1 10

1/ Vertical plywood sides

2/ Low flows (no bending or submergence of vegetation)

"The first experiment on channel U8 was completed during August. Calculations have been carried to the point where some results can be offered.

"Channel U8 was constructed early this year and sodded solid during the latter part of March with smooth brome taken from the laboratory nursery. In June the brome was flourishing but by the first of August most of this grass had died. At the time of testing other volunteer vegetation predominated. These grasses included crabgrass, needle grass, and 'tackle grass'. It was decided to test the channel because the cover was probably very similar to that which might be obtained in the field under 'let alone' conditions.

"This channel was of the unit type with a 3 foot flat bottom and vertical plywood side walls. The bed slope was 5 percent. The soil in the bed was Dougherty Silt Loam.

"The channel was subjected to 17 flows ranging in rate from 0.044 c.f.s. to 68.1 c.f.s. The n-VD data are summarized in the following table:

Table 2

$VD^{1/}$	Manning's <u>n</u>	$VD^{1/}$	Manning's <u>n</u>
0.0015	0.38	0.387	0.16
.0032	.30	.621	.12
.0059	.25	1.49	.063
.012	.20	2.18	.053
.022	.21	3.47	.051
.053	.21	6.57	.041
.109	.28	9.77	.037
.188	.27	16.0	.035
		22.7	.035

1/ Product of velocity and depth.

"The channel bottom started to scour at a mean velocity of 4 feet per second. At 7 feet per second the scour rate was becoming excessive. The mixture of grasses thus offered some protection to the channel but not as much as a sod. In general it might be said that most any grass, even like the undesirable species in this channel, is better than no cover at all."

Sedimentation Studies - L. C. Gottschalk, Washington, D. C.-

"Work plans were developed for an investigation of methods of stream-bank stabilization to be carried out in cooperation with the Cornell University Agricultural Experiment Station at Ithaca, N. Y. The objectives of this project are to determine the effectiveness of the various methods of stream-bank protection now in use in New York and New England and to develop criteria for planning and design of effective and economical methods of control for use in flood control and districts programs. Vernon J. Palmer has been assigned as project leader to carry out these studies.

"Carl B. Brown prepared a report on the Rio Grande sediment conference held at Albuquerque, New Mexico, August 19-22, 1946, under the sponsorship of the Federal Inter-Agency River Basin Committee. This report summarizes the nature of the sediment problem in the Rio Grande drainage basin above Elephant Butte Dam and outlines the scope of proposed cooperative investigations."

Drainage Studies - W. J. Liddell, Athens, Georgia.-"Rains were well spaced in September. Two irrigations were made on the vegetables; 1/2-inch of water was applied on September 6, and 0.75 inch on September 10. The latter application was followed that night by a shower which gave 1 inch of rain. The pastures and corn were not irrigated.

"On September 6 an inspection of the disease incidence in the corn was made with Dr. M. J. Murray, plant pathologist of the College. There was a considerable amount of Rust infestation on the leaves, but there was no apparent difference from plot to plot, or between the irrigated and unirrigated plots. There was no heavier infestation in the more closely spaced plots as might be expected. Stewart's disease, fusarium, and smut were present in small amounts.

"An attempt was made to improve spring flow into the check pasture by dynamiting the source of a seepage spring in an adjacent hillside pasture. Flow does not seem to have been improved, but mud was blasted from a reservoir which made for much better drinking for livestock. A further attempt with dynamite was made in the pasture check to stop subsurface flow of water under a terrace channel. This water came to the surface just below the terrace causing a marshy, wet spot with the accompanying undesirable vegetation.

"The charge was placed in the terrace channel with the idea of intercepting the subsurface water, forming a reservoir for livestock to use in drinking, and allowing the surplus water to flow down the established terrace channel and out the drain ditch. Results from this are apparently good at this stage."

Drainage Studies - James Turnbull, Lake Alfred, Florida.-"During the month additional data were obtained on interception of rainfall by orange and grapefruit trees. Data are now available on 28 separate rainfalls ranging from 0.02 inch to 1.71 inches. Maximum interception observed for orange trees was 80 percent which occurred during a rainfall of 0.03 inch. Maximum interception for grapefruit trees was 70 percent which occurred during an 0.02 rainfall. Minimum interception for both orange and grapefruit trees occurred after a rainfall of 1.71 inches and was 0.4 percent and 5.4 percent for oranges and grapefruit, respectively.

"Water table wells reached their highest level between August 26 and September 3 and since that time have dropped steadily. At the end of September the well furthest from the lake, which has had the greatest elevation consistently, was only 0.64 feet above lake level."



Drainage Studies - C. Kay Davis, The Everglades Project, Fort Lauderdale, Florida.-"We were able to make some comparisons with ditch spacings during the past month. One of the sections (Section 10) was cut up into small areas with ditch spacings at 1/8 mile. The ditch spacing on Section 4 was constructed at 1/4 mile. There is apparently a decided advantage in spacing the ditches at 1/8 mile, even for grass. Where the ditch spacing is at 1/4 mile intervals the water table may be brought below the surface but the surface is too boggy and the cattle seem to tramp down more grass than they eat. Part of Section 10 was mole drained in addition to the 1/8 mile ditch spacing. Apparently the mole drains did not give sufficient additional drainage to justify its installation. In other words, the depth from the surface to the wet soils in the mole drained area was about the same as adjacent areas which were not mole drained.

"We received six soils maps for the area below the Tamiami Trail and they are excellent. I am persuaded to believe that there will be much greater demand for these maps than I originally estimated.

"As a result of our soils, topographic, and geological surveys definite progress is being made to use Everglades lands in accordance with the soils classifications. The State has dedicated two water retention areas and is withholding sales on other areas where our soils survey indicates marginal lands. The above-normal rainfall in the area immediately south of Lake Okeechobee has precipitated a willingness on the part of the farmers at least to recognize the necessity of correcting some of the existing conditions. Another wet year next year and I believe there will be a movement started to install pumps near the hurricane gates so as to pump some of the canal waters back into the Lake.

"This year they wanted to lower the Lake so that the canal waters would flow by gravity back into the Lake but the U. S. Army Engineers were reluctant to lower the Lake, and are attempting to maintain a Lake level in accordance with the R - E formula. If the Army Engineers maintain their stand and do not lower the Lake to please a few of the big farmers in the area, then we may get somewhere with the installation of pumps as recommended in our report."

Drainage Studies - M. H. Gallatin, Homestead, Florida.-

"Analysis of chloride samples for the Miami area shows a slight drop for this period. This is due to the heavy rainfall that has occurred during this period. In many cases water was standing on the ground surface.

"In general, chlorides for the east ('Glades area are low). Results of recent sampling in the Station's East 'Glades experimental plots shows that the chlorides have dropped from 12.000 to 15.000 p.p.m. to 100 to 175 p.p.m."

IRRIGATION DIVISION

The following report is for August.

Evaporation - Transportation Losses - Bloodgood reports.-"The evaporation losses from a standard Weather Bureau type A pan at Buchanan Dam for June and July were 8.53 and 13.31 inches; while at Mansfield Dam the losses for the same months were 8.35 and 10.56 inches, respectively. The evaporation losses from a Division of Irrigation pan at Buchanan Dam for June and July were 6.62 and 10.26 inches; while at Mansfield Dam for the same months the losses were 6.44 and 9.15 inches. The evaporation losses from a Bureau of Plant Industry pan at Buchanan Dam for June and July were 7.46 and 11.10 inches. The total precipitation at Buchanan Dam for June was 1.41 inches and none for July; while at Mansfield Dam, it was 2.42 inches for June and 0.57 inch for July."

Young reports.-"Three evaporation stations were established in the Huntington Lake area of the Sierra Mountains at elevations from 5,400 to 9,400 feet as a basis for estimating evaporation losses from storage reservoirs operated by the Southern California Edison Company. A fourth station will be placed in operation next spring.

"The relation between evaporation from water surfaces and altitude often is inconsistent because of local climatic influences." Evaporation losses are expected to decrease at higher elevations because of lower temperatures and shorter seasons and generally this condition exists but sometimes local conditions alter or even reverse the usual trend. Evaporation at Cuyamaca Reservoir, elevation 4,640 feet, in San Diego County, California, is greater than at other reservoirs in the County situated at lower elevations because it is sufficiently distant to avoid the oceanic influence and is frequently subject to dry winds from the desert lying in the opposite direction. This condition has been found also in Los Angeles County. In the central portion of California conditions are different, the valleys are hot in summer and temperatures are cooler at higher elevations, consequently the evaporation losses are less in mountain areas. At present there are no evaporation records in the Huntington Lake area."

Methods of Water Application - Bloodgood reports on Irrigation of Rice in the Katy Area near Houston. Water is supplied from pumps. On the Wood farm one pump discharges 2,160 g.p.m. This flow, together with water from another plant, supplies water for 590 acres of rice. The irrigation of rice is continuous and the irrigation season 90 days or more.

Muckel reports.-"The average seasonal application of water for oranges amounts to 1.56 feet, for avocados 2.88 feet, and for the entire area under the Escondido Mutual Water Company the average seasonal application is 1.72 feet. By applying irrigation efficiencies determined by Beckett and Blaney and deducting losses by evaporation from water soil



mulch, it was found that 38 percent of the water applied penetrated below the root zone and becomes return flow to the lower part of the Valley."

Lining of Irrigation Canals and Ditches - Lauritzen reports.-"Observation of experimental linings in Channel A was continued. There has been a gradual reduction in the permeability of most of the linings since their installation. The relative permeability computed from measurements made August 30, 1946 are listed below:

TEST

No.	Treatment	:Coefficient of : Permeability : ft. per yr.
1 A	Oasis clay uncompacted	.699
2 A	Sandy loam 100 parts, Redmond Bentonite 5 parts	.261
3 A	Sandy loam 100 parts, Redmond Bentonite 2 parts	69.831
4 A	Clay loam	76.239
5 A	Clay loam	14.473
6 A	Sandy loam + light oil (16 API gravity)	33.7184
7 A	Sandy loam 100 parts - Redmond Bentonite 10 parts	.0625
8 A	Oasis clay compacted	.2388

"Some difficulty was experienced when the water was first turned in, with failure of the linings. The failures took the form of wash outs and seemed to originate in drying cracks in the case of linings 4 A, 5 A, and 8 A. The drying cracks developed during the interval between the time of placing the respective linings and the time the water was turned into the channel. Failure in the case of 1 A apparently resulted from highly permeability zones in the uncompacted material. It is significant that tests 2 A, 3 A, and 7 A were not subject to cracking even though opportunity for drying, particularly in the case of 7 A, was greater than for any other lining. True, some fine dry cracks could be observed in 7 A, however, these never developed to a point which resulted in making the lining sufficiently porous to involve the hazard of failure. Lining 3 A failed a number of times during the initial period and had to be patched. Failure in this case apparently was due to the bentonite in the mixture being insufficient to stabilize the material. Lining 6 A failed a number of times immediately following the time the water was turned into the channel. In order to avoid these failures in the initial period we have adopted the practice of capping the outlets until the linings have a chance to swell and stabilize. While this procedure might be criticized, it is felt it might be justified because of the greater opportunity which the experimental facilities offer to failures of this type as compared with canals. It does appear, however, that this tendency of the lining to fail may have an important bearing



on behavior under field conditions, particularly canals which are subject to intermittent use. Considerable erosion at the water line from wave action is exhibited by all linings except 6 A. The characteristics under cutting to be observed along the banks of all earth canals is evident."

Sand Traps - Parshall reports. - "Laboratory studies of the riffle deflector sand trap indicates that the curved and straight deflectors are about equally effective, but that the straight deflector type has some advantages in construction."

Parshall reports the installation of about 20 Parshall Flumes on the Cactus Hill lateral near Fort Collins. Some of the water users were dissatisfied with the new measuring devices. Upon inspection it was found that these dissatisfied water users were those who had been enjoying the use of the other fellow's water because of previous faulty measurement or no measurement at all. After frank discussion among the farmers all agreed as to the accuracy of the Parshall flume and now there is general satisfaction among the users and a more equitable distribution of the water.

Pumping for Irrigation - Rowher reports. - "Tests of the loss of head through gate valves at various gate openings were continued during August at the Bellvue laboratory. The tests on a 12-inch valve were completed and equipment was installed for making tests on a 6-inch gate valve and a 6-inch swing check valve. A comparison of the losses indicated by the recent tests on a 12-inch gate valve with those on another valve of a different type shows that the greatest deviation occurred when the valves were  $1/4$  open. Greater deviation should be expected when the opening is small because the effect of differences in shape of the orifices is relatively greater under these circumstances."

Imperial Valley Drainage Investigations - Donnan reports. - "Eighteen piezometric observation wells were installed in two east-west lines on the Albert Nichols Ranch. Readings were secured of the water table elevations just prior to the irrigation which was made on Friday, August 9th.

"Samples of the leachate from the O'Dwyer-Mets tile system are being secured every other day. Analysis reveals a steady drop in the amount of total dissolved salts as the leaching progresses. Water was turned onto the property on August 20th and has been ponded about nine inches deep over the field since that date. Flow from the tile line is estimated at 100 gallons per minute.

"All the field work on the north 160 acres of the Sperry property was completed. Borings revealed an ideal aquifer and the water table observations from 25 piezometers indicate that the source of water is primarily on site. A tile spacing was calculated for this property using the tile spacing formula and it is anticipated that the tile will be

installed sometime in early October. This project should evolve into a worthwhile check of the tile spacing formula. The only problem of design of the system stems from the fact that the 160-acre field is so flat it will be difficult to maintain the tile lines at ideal depth on the upper reaches of the system."

Gwillim reports.-"Investigation was made of drainage problems in Bonner County, Idaho. Much of the bottomland and lands bordering Lake Pond Oreille is flooded during the spring when the lake surface raises from spring runoff. The maximum raise of the lake surface is approximately 30 feet and the average raise is 16 feet. As the lake raises it overflows the lowland from Albany Falls to the head of the lake. The outflow of the lake is controlled by a natural rock barrier which holds the water back gradually lowering the lake surface during the summer months. Diking to prevent flooding does not appear practical because of the high cost. Natural hay is cut from the flooded area in the early fall and good pasture is grown. Farmers do not appear interested in flood prevention. Drain ditches in some of the flooded valleys would expedite the runoff from the land."

Miscellaneous.-A conference was held at Logan August 27, 28, and 29 to develop a program of Irrigation and Drainage Research for consideration under the Bankhead-Flannagan Bill. This meeting was attended by Mitchelson, Parshall, Marr, Criddle, Wood, Barrett, and Clyde. Blaney was ill. At this conference a master project covering hydrology, as it relates to Irrigation and Drainage, was prepared, together with 14 sub-projects. This project, with its sub-projects, is designed for cooperation with one or more or all of the Agricultural Experiment Stations of the 17 Western States. This proposal has been submitted to the Chief of Research for his consideration.

This report is for September.

Irrigation Efficiency Studies.-Aronovici reports progress in his studies of irrigation efficiencies in the Antelope Valley, California. His work, to date, indicates that the irrigation efficiency is a function of the moisture level at the time of irrigation as well as the slope and size of stream. A determination of the most favorable irrigation time from the standpoint of the crop will aid greatly in irrigation layout planning.

Evaporation - Transpiration Losses.-Muckel reports that the report of the San Luis Rey Investigations is being used to guide the development of that valley. The plans involve a dam on the San Luis Rey River. The question is how much water will be saved by the reduction in consumptive use along the valley floor by reason of clearing the reservoir site of vegetation. Usually evaporation losses have been charged against storage but no credit taken for reduction in consumptive use.



The San Luis Rey Investigations indicate that the saving of water by clearing the reservoir site more than balances the losses from evaporation expected from the free water surface in the reservoir.

Snow Surveys.-Fuhriman reports the completion of an analysis of past records of all snow courses in the Utah cooperative network. This analysis, made prior to the summer maintenance program, indicated need-ed revision of many courses and abandonment of some. The analysis show-ed that often short courses well located yielded better results than many long courses previously established. Based on this analysis many Utah snow courses were shortened in length and some of them abandoned. To increase the efficiency of snow surveys a constant effort is being made to reduce the cost and increase the accuracy of the forecasts.

Sand Traps.-Parshall reports continued experiments on riffle deflector-vortex tube sand trap. The model studies seem to indicate that not more than six riffles will be necessary to relieve the bed load. These studies also indicate that a combination of a curved and straight riffle will be most effective.

Much interest is being expressed by irrigation companies all over the West in the sand trap development. Several large structures are being installed and these will provide an opportunity to field check the model studies in the laboratory.

Drainage of Irrigated Land.-During the month Donnan completed a paper entitled, "Model Tests of the Tile Spacing Formula." This paper, based on the drainage research at Imperial, California, will be presented at the meetings of the Soil Science Society of America in November.

A paper entitled, "The Mechanical Analysis as an Index of Subsoil Permeability," has been prepared by Aronovici. This paper, based on research findings in the drainage investigations at Imperial, will be presented at the meetings of the Soil Science Society of America in November.

Irrigation Institutions.-Hutchins reports completion of the final report of the "Committee on Desirable Principles of State Water Legislation." This report will be presented by Hutchins at the meetings of the National Reclamation Association at Omaha October 9-11, 1946. "The report contains, in a large measure, a selection from the various water codes of those principles which the committee members consider most generally desirable, together with some matters decided by the courts and either not covered or inadequately covered by existing statutes. In other words, most of the individual points included in the report are already part of the water law in one state or another. The result is largely a composite from many sources." The report consists of five parts:



1. General principles
2. Appropriation of water
3. Procedure for appropriating water
4. Determination and adjudication of water rights
5. Administration of water rights and distribution of water.

Erosion from Irrigation.-Mech reports, "Irrigation, after reditching of the alfalfa plots, showed heavy soil losses. This appears to be due entirely to the disturbance of the irrigating furrow. After the loose soil is removed subsequent irrigations produce considerably less soil movement."

Hope-Flannagan Research Proposal.-A master research project covering Hydrology as it relates to Irrigation and Drainage was proposed by members of the Irrigation Division staff. This proposal was submitted to Dr. Nichols and later presented to the Directors of the eleven Western State Experiment Stations assembled at Logan, Utah. This proposal was well received and endorsed by the Directors. They are jointly making recommendations to the Secretary of Agriculture, the Chief of Office of Experiment Stations, the Agricultural Research Administrator, and the Chief of Office of Research of Soil Conservation Service.

The Directors of the eleven Western State Experiment Stations were each given a copy of the proposal for their review and criticism. These are to be returned with their comments and suggestions for cooperative research.